AP Chemistry
Salts and Buffers

1. Salt in question: NaF. Ka for HF = 6.7×10^{-4}
   a. Is this salt acidic/basic or neutral?

N - B
NaF

   b. Write the hydrolysis reaction.

$F^- + H_2O \rightleftharpoons HF + OH^-$

   c. Write the equilibrium expression for "b".

$K_b = \frac{[HF][OH^-]}{[HF]}$

   d. Write the hydrolysis reaction for the conjugate.

$HF + H_2O \rightleftharpoons H_3O^+ + F^-$

   e. Write the equilibrium expression for "d".

$K_a = \frac{[H_3O^+][F^-]}{[HF]}$

   f. In a .1M NaF solution what is the pH?

$1.0E-14 / 6.7E-4 = 1.49E-11 = \frac{x^2}{.1}$ $x = 1.2E-6$
$-\log(1.2E-6) = 5.9$
$14 - 5.9 = 8.08$

   g. What is the percent dissociation for "f".

$\frac{1.2E-6}{0.1} \times 100 = 0.0012\%$

   h. Estimate or calculate the pH of the following solutions.
   - [HF] = 0.1M [NaF] = 0.1M pH = $-\log(K_a) = 3.17$
   - [HF] = 1.5M [NaF] = 1.5M pH = 3.17
   - [HF] > [NaF] estimate pH (acidic/basic/neutral/need more info)
   - [HF] = [NaF] estimate pH (acidic/basic/neutral/need more info)
   - [HF] < [NaF] estimate pH (acidic/basic/neutral/need more info)

Ka $Ka = 6.7E-4$
K_b
$1.0E-7$

Buffer: A weak acid/base conjugate competing against each other.

   i. To a beaker a 1M HF and 1 M NaF is added.
      a. Considering the Ka value will this solution be acidic/basic or neutral?

Acidic

      b. What is the pH?

$6.7E-4 = \frac{1 \cdot x}{1}$
$x = 6.7E-4 \Rightarrow -\log(\ ) = 3.17$
3.17

      c. If you want to make a solution that is basic which will be in higher concentration, NaF or HF? Explain?

must be higher, much higher, due to larger Ka.

2. Salt in question: NH_4Cl. Ka for $NH_4^+ = 5.6 \times 10\text{-}10$

a. Is this salt acidic/basic or neutral?

NH_4^+ acidic

b. Write the hydrolysis reaction.

$NH_4^+ + H_2O \rightleftharpoons NH_3 + H_3O^+$

c. Write the equilibrium expression for "b".

$$K_a = \frac{[NH_3][H_3O^+]}{[NH_4^+]}$$

d. Write the hydrolysis reaction for the conjugate.

$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

e. Write the equilibrium expression for "d".

$$K_b = \frac{[NH_4^+][OH^-]}{[NH_3]}$$

f. In a .1M NH_4Cl solution what is the pH?

$$5.6E\text{-}10 = \frac{x \cdot x}{0.1} \qquad x = \sqrt{7.4E\text{-}6} \qquad -\log(\quad) = 5.12$$

g. What is the percent dissociation for "f".

$$\frac{7.4E\text{-}6}{0.1} \times 100 = 0.0074\%$$

Buffer: A weak acid/base conjugate competing against each other.

h. To a beaker a 1M NH_4Cl and 1 M NH_3 is added.

d. Considering the Ka value will this solution be acidic/basic or neutral? (large K_b)

$$K_a = \frac{1 \cdot x}{1} \qquad x = 5.6E\text{-}10$$

e. What is the pH?

$$-\log(\quad) = 9.25$$

f. If you want to make a acidic solution which will be in higher concentration, NH_3 or NH_4Cl? Explain

↑ much higher due to ↑ K_b or ↓ K_a